ABSTRACT

A distinctive reflection known as the Bottom Simulating Reflection (BSR) has been widely recognized as one of the major geophysical indicator for marine gas hydrate geological system all over the world. However, the scientific drilling has showed that there is not a strict one-to-one correspondence relation between gas hydrate and BSR. The presence of a BSR may be not a strong indicator that at least a small amount of gas hydrate is present and gas hydrate has been documented where no BSR is observed, and the lack of a BSR does not imply that gas hydrate is absent. Based on the analysis of the non-sufficient & necessary relation and its reasons between gas hydrate and BSR, the seismic recognition methods and their implication for gas hydrate in the non-BSR regions were studied in the present paper. Focused on Shenhu area, northern South China Sea where the gas hydrate is documented by drilling, the seismic data processing and reversion showed that the gas hydrate layer is of the high layer velocity, high P-impedance, high instantaneous frequency, and the interval velocity reverse, P-impedance inversion and instantaneous feature analysis may be the effective methods for recognition of gas hydrate in the non-BSR region. Combination of these methods may effectively improve the recognition accuracy of gas hydrate layer especially in the non-BSR region. The gas hydrate recognition was reached a good result by using the interval velocity reverse, P-impedance inversion and instantaneous feature analysis in the non-BSR region of Southeast Hainan Basin, South China Sea.

Keywords: gas hydrates, non-BSR-region, velocity, impedance, instantaneous frequency

1. INTRODUCTION

The stratum, contains gas hydrate, always shows high speed and high impedance, so the seismic exploration method which based on detection of these anomalies is one of effective approach to identify gas hydrate [1]. Studies prove that BSR, as a significant feature, is one of the most effective indicators of gas hydrate [2-4]. However, at the typical sea areas which contain gas hydrate, such as Blake Ridge, Mexico Gulf and Hydrate Ridge, there is no strict correspondence relationship between gas hydrate and BSR [5-9]. Consequently, how to detect gas hydrate in non-BSR-region becomes a valuable research. Stack velocity plays an important role in gas hydrate detection. Ecker et al. used the results of stack and stratum velocity analysis in their rock physical model, hydrate saturation and free gas saturation of Blake Ridge had been worked out [10]. Katzman et al. proved that the P-wave velocity of gas hydrate contained formation, beyond the BSR, significantly higher than the surroundings, was between 1.9 to 2.0 km/s by velocity analysis and acoustic inversion [11].